

## REVIEW ARTICLE

# Significance of Herbal Drugs for Care of Diabetes

Shyam Bihari Sharma<sup>1\*</sup>, Sunisha Kulkarni<sup>1</sup>, Vaibhav Srivastava<sup>2</sup>

<sup>1</sup> School of Studies in Pharmaceutical Sciences, Jiwaji University, Gwalior 474001 (India)

<sup>2</sup> Nagaji Institute of Pharmaceutical Sciences, Gwalior 474001 (India)



\* For correspondence

Email: shyam\_mpharm06@rediffmail.com

### Key words

Herbal drugs, Traditional medicine, Herbal supplements, Blood glucose, Islets of Langerhans

### Abstract

Diabetes is a metabolic disorder where in human body does not produce or properly uses insulin, a hormone that is required to convert sugar, starches, and other food into energy. Human body has to maintain the blood glucose level at a very narrow range, which is done with insulin and glucagon. Though there are various approaches to reduce the ill effects of diabetes and its secondary complications, herbal formulations are preferred due to lesser side effects and low cost. Over 400 traditional plant treatments for diabetes have been reported, although only a small number of these have received scientific and medical evaluation to assess their efficacy. A list of medicinal plants with proven antidiabetic and related beneficial effects and of herbal drugs used in treatment of diabetes is compiled. These include, *Allium sativum*, *Eugenia jambolana*, *Momordica charantia*, *Ocimum sanctum*, *Phyllanthus amarus*, *Pterocarpus marsupium*, *Tinospora cordifolia*, *Trigonella foenum graecum* and *Withania somnifera*. The natural herbs for diabetes treatment focus on lowering blood sugar and reducing the damaging effects of the disease. Herbal supplements for diabetes has been a part of a holistic approach to treatment that addresses proper nutrition, a good exercise program, and continued monitoring of blood glucose level. Herbal remedy for diabetes containing a collection of medicinal herbs and other natural ingredients known to support pancreatic health, promote systemic balance and the healthy functioning of the Islets of Langerhans in the pancreas which is responsible for insulin production. There are some natural herbs used for treatment of diabetes are Cinnamon, Bitter melon, *Gymnema Sylvestre*, Goldenseal, *Panax Ginseng*.

## INTRODUCTION

Diabetes is a chronic disorder of carbohydrate, fat and protein metabolism characterized by increased fasting and post prandial blood sugar levels. It is a metabolic disorder where in human body does not produce or properly uses insulin, a hormone that is required to convert sugar, starches, and other food into energy. Type I diabetes (insulin dependent) is caused due to insulin insufficiency because of lack of functional beta cells. Patients suffering from this are therefore totally dependent on exogenous source of insulin while patients suffering from Type II diabetes (insulin independent) are unable to respond to insulin and can be treated with dietary changes, exercise and medication.<sup>1</sup>

In type II diabetes mellitus (non-insulin-dependent diabetes), the pancreas continues to manufacture insulin, sometimes even at higher than normal levels. However, the body develops resistance to its effects and the sugar in the blood does not enter the cells as well as it should resulting in higher blood sugar levels. Type II diabetes usually begins after age 30 and becomes progressively more common with age. Obesity is a risk factor for type II diabetes; 80 to 90 percent of the people with diabetes are obese. Symptoms for both diabetic conditions may include: (i) high levels of sugar in the blood; (ii) unusual thirst; (iii) frequent urination; (iv) extreme hunger and loss of weight; (v) blurred vision; (vi) nausea and vomiting; (vii) extreme weakness and tiredness; (viii) irritability, mood changes etc.<sup>1</sup>

In the last few years there has been an exponential growth in the field of herbal medicine and these drugs are gaining popularity both in developing and developed countries because of their natural origin and less side effects. A number of medicinal plants, traditionally used for over 1000 years named rasayana are present in herbal preparations of Indian traditional health care systems.<sup>1-3</sup> There are many Medicinal plants are being looked up for the treatment of diabetes. Many conventional drugs have been derived from prototypic molecules in medicinal plants. To date, over 400 traditional plant treatments for diabetes have been reported, although only a small number of these have received scientific and medical evaluation to assess their efficacy. The hypoglycaemic effect of some herbal extracts has been confirmed in human and animal models of type 2 diabetes.<sup>1</sup>

## NATURAL SUPPLEMENTS FOR TREATMENT OF DIABETES

Around the world, the incidence of diabetes mellitus is increasing rapidly. Changing the diet and take some supplements helps to prevent development of diabetes and to control blood glucose concentrations. Traditional herbs and spices also can be used to control blood glucose concentrations. Allspice, cinnamon, bay leaf, cloves, nutmeg, witch hazel, oregano, and black and green tea have been shown to have an insulin-like biological activity.<sup>2-3</sup> Of these substances, cinnamon has been shown to have the highest bioactivity. A water-soluble polyphenol typ-A polymer from cinnamon has been isolated and shown in vitro to have insulin-like activity as well as an antioxidant effect.<sup>4</sup> Apart from this, there are some other natural supplements used for treatment of diabetes, which are described below:<sup>5-6</sup>

1. *Alpha lipoic acid* is one of the most important nutrients to consider for diabetes. Alpha Lipoic acid has been evaluated for blood sugar control, and it may also be considered in diabetic neuropathy and kidney disease. A dose of 30 to 50 mg two or three times a week appears to be appropriate.
2. *Stevia* is a no calorie natural sweetener and a wonderful alternative to sugar as well as artificial sweeteners.
3. *Fish oils* maintain healthy blood flow, especially in the microcirculation.
4. *Carnitine* can reduce oxidative stress in diabetic patients.
5. *Fenugreek* helps support healthy blood sugar levels.
6. *Acetylcarnitine* is a promising treatment for diabetic neuropathy, usually at a dose of 100 to 400 mg daily.
7. *CoQ10* improves the function of endothelial cells lining blood vessels and may slightly help with blood sugar control.
8. *Psyllium* can lower cholesterol levels.
9. *Chromium* increases insulin sensitivity and binding, also increases number of insulin receptors.
10. *Magnesium* may help lower blood pressure in those with diabetes. Getting enough magnesium in the diet could help reduce the risk of getting this blood sugar management disease. Supplements of this

mineral improve insulin sensitivity. Dietary sources of magnesium include green, leafy vegetables, meats, starches, grains and nuts, and milk.

11. *Astragalus* may be helpful in diabetic nephropathy.

12. *Whey protein* is useful for people with type 2 diabetes. Adding whey to high-carbohydrate meals stimulates insulin release and reduces spikes in blood glucose levels after meals.

## HERBAL DRUGS FOR DIABETES

Many medicinal herbs are traditionally used for treatment of diabetes. Some of the important medicinal plants, their active parts and active phytochemicals are given in Table 1.

Table 1. Traditional antidiabetic plants

Plants	Location of use	Active part	Active substance
<i>Allium cepa</i>	Asia, Europe, Middle East	Bulb	Alkyldisulfides
<i>Allium sativum</i>	Asia, Europe, Middle East	Bulb	Alkyldisulfides
<i>Blighia sapida</i>	Africa, Central America	Fruit (unripe)	Hypoglycins (aminopropyl-propionic acid derivatives)
<i>Catharanthus roseus</i>	Africa, Asia, Europe, Australasia	Leaf	Alkaloids
<i>Coccinia indica</i>	Asia	Leaf	Uncharacterized alkaloids
<i>Cyamopsis tetragonolobus</i>	Asia	Seed and pod	Galatomannan (polysaccharide)
<i>Emericella quadrilineata</i>	Asia	Fruit body	Aminobutyric acid derivative
<i>Ficus bengalensis</i>	Asia	Stem bark	Uncharacterized glycoside
<i>Calega officinalis</i>	Europe	Leaf	Cuanidine
<i>Cymnema sylvestre</i>	Asia, South Africa	Leaf	Uncharacterized glycoside
<i>Momordica charantia</i>	Asia, Australasia, Central America, West Africa	Aerial	Uncharacterized glycosides and alkaloids
<i>Momordica foetida</i>	West Africa	Aerial	Uncharacterized glycosides
<i>Oryza sativa</i>	Orient	Root	Oryzarans (polysaccharides)
<i>Panax ginseng</i>	Orient	Root	Panaxans (polysaccharides)
<i>Saccharum officinarum</i>	Orient	Stalk	Saccharan C (polysaccharide)
<i>Trigonella foenumgraecum</i>	Asia, Europe	Seed	Trigonelline (alkaloid)
<i>Vaccinium myrtillus</i>	Europe, North America	Leaf	Neomyrtillin (glycoside)

Various ether soluble fractions as well as insoluble fractions of dried onion powder show anti-hyperglycemic activity in diabetic rabbits. *Allium cepa* is also known to have antioxidant and hypolipidaemic activity. Administration of a sulfur containing amino acid from *Allium cepa*, S-methyl cysteine sulphoxide (SMCS) (200 mg/kg for 45 days) to alloxan induced diabetic rats significantly controlled blood glucose as well as lipids in serum and tissues and normalized the activities of liver hexokinase, glucose 6-phosphatase and HMG Co A reductase.<sup>6,7</sup> When diabetic patients were given single oral dose of 50 g of onion juice, it significantly controlled post-prandial glucose levels. Allicin, a sulfur-containing compound in *Allium sativum* is responsible for its pungent odour and it has been shown to have significant hypoglycemic activity. This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells and/or insulin sparing effect.<sup>8</sup>

Aloe vera gel is the leaf pulp or mucilage, aloe latex, commonly referred to as “aloe juice,” is a bitter yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves.<sup>9,10</sup> Extracts of aloe gum effectively increases glucose tolerance in both normal and diabetic rats. Treatment of chronic but no single dose of exudates of *Aloe barbadensis* leaves showed hypoglycemic effect in alloxanized diabetic rats.

Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats. This action of *Aloe vera* and its bitter principle is through stimulation of synthesis and/or release of insulin from pancreatic beta cells.<sup>10</sup>

Hydroalcoholic extracts of *Azadirachta indica* showed anti-hyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemidiaphragm.<sup>11</sup> In India decoction of kernels of *Eugenia jambolana* is used as household remedy for diabetes. This also forms a major constituent of many herbal formulations for diabetes.<sup>12</sup> Antihyperglycemic effect of aqueous and alcoholic extract as well as lyophilized powder shows reduction in blood glucose level.<sup>12</sup> The aqueous extract of *Mangifera indica* possesses hypoglycemic activity. This may be due to an intestinal reduction of the absorption of glucose.<sup>13</sup> *Momordica charantia* is commonly used as an antidiabetic and antihyperglycemic agent in India as well as other Asian countries. Extracts of fruit pulp, seed, leaves and whole plant was shown to have hypoglycemic effect in various animal models. Polypeptide p, isolated from fruit, seeds and tissues of *M. charantia* showed significant hypoglycemic effect when administered subcutaneously to langurs and humans.

The aqueous extract of leaves of *Ocimum sanctum* showed the significant reduction in blood sugar level in both normal and alloxan induced diabetic rats.<sup>14</sup> Significant reduction in fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride and total lipid indicated the hypoglycemic and hypolipidemic effects of tulsi in diabetic rats. Oral administration of plant extract (200 mg/kg) for 30 days led to decrease in the plasma glucose level by approximately 9.06 and 26.4% on 15 and 30 days of the experiment respectively. Oral administration of the extract of *Tinospora cordifolia* roots for 6 weeks resulted in a significant reduction in blood and urine glucose and in lipids in serum and tissues in alloxan diabetic rats.<sup>15</sup>

## CONCLUSION

Diabetes is possibly the world's fastest growing metabolic disease, and as knowledge of the heterogeneity of this disorder increases, so does the need for more appropriate therapies. Traditional plant medicines are used throughout the world for a range of diabetes treatment and its care also. The study of such medicines might offer a natural key to unlock for a Diabetes care in patients and diabetologist's pharmacy for the future.

## DECLARATION OF INTEREST

It is hereby declared that this paper does not have any conflict of interest.

## REFERENCES

1. Ramachandran A, Snehalatha C, Viswanathan V. Burden of type 2 diabetes and its complications - the Indian scenario. *Curr Sci.* 2002; 83: 1471-1476.
2. Scartezzini P, Sproni E. Review on some plants of Indian traditional medicine with antioxidant activity. *J Ethnopharmacol.* 2000; 71: 23-43.
3. Broadhurst CL, Polansky MM, Anderson RA. Insulin-like biological activity of culinary and medical plant aqueous extracts in vitro. *J Agric Food Chem.* 2000; 48: 849-52.
4. Anderson RA, Broadhurst CL, Polansky MM, et al. Isolation and characterization of polyphenol type-A polymers from cinnamon with insulin-like biological activity. *J Agric Food Chem.* 2004; 52: 65-70.
5. Roman-Ramos R., Flores-Saenz JL, Alaricon-Aguilar FJ. Antihyperglycemic effect of some edible plants. *J Ethnopharmacol.* 1995; 48: 25-32.
6. Kumari K, Mathew BC, Augusti KT. Antidiabetic and hypolipidaemic effects of S-methyl cysteine sulfoxide, isolated from *Allium cepa* Linn. *Ind J Biochem Biophys.* 1995; 32: 49-54.
7. Mathew PT, Augusti KT. Hypoglycemic effects of onion, *Allium cepa* Linn. on diabetes mellitus- a preliminary report. *Ind J Physiol Pharmacol.* 1975; 19: 213-217.
8. Sheela CG, Augusti KT. Antidiabetic effects of S-allyl cysteine sulphoxide isolated from garlic *Allium sativum* Linn. *Indian J Exp Biol.* 1992; 30: 523-526.
9. Al-Awadi FM, Gumaa KA. Studies on the activity of individual plants of an antidiabetic plant mixture. *Acta Diabetologica.* 1987; 24: 37-41.

10. Ajabnoor MA. Effect of aloes on blood glucose levels in normal and alloxan diabetic mice. *J Ethnopharmacol.* 1990; 28: 215-220.
11. Chattopadhyay RR, Chattopadhyay RN, Nandy AK, Poddar G, Maitra SK. The effect of fresh leaves of *Azadiracta indica* on glucose uptake and glycogen content in the isolated rat hemidiaphragm. *Bull Calcutta Sch Trop Med.* 1987; 35: 8-12.
12. Acherekar S, Kaklij GS, Kelkar SM. Hypoglycemic activity of *Eugenia jambolana* and *ficus bengalensis*: mechanism of action. *In vivo.* 1991; 5: 143-147.
13. Aderibigbe AO, Emudianughe TS, Lawal BA. Antihyperglycemic effect of *Mangifera indica* in rat. *Phytother Res.* 1999; 13: 504-507.
14. Vats V, Grover JK, Rathi SS. Evaluation of antihyperglycemic and hypoglycemic effect of *Trigonella foenum-graecum* Linn, *Ocimum sanctum* Linn and *Pterocarpus marsupium* Linn in normal and alloxanized diabetic rats. *J Ethnopharmacol.* 2002; 79: 95-100.
15. Stanely P, Prince M, Menon VP. Hypoglycemic and hypolipidemic action of alcohol extract of *Tinospora cordifolia* roots in chemical induced diabetes in rats. *Phytother Res.* 2003; 17: 410-413.

Disclaimer: This paper was not reviewed by the editorial board / reviewers of *Journal of Chronotherapy and Drug Delivery*

This page is intentionally  
left blank